CLAIMS:

1. A method of forming a metal layer on a substrate, the method comprising:

providing a substrate in a process chamber;

exposing the substrate to a reducing gas;

exposing the substrate to a pulse of a metal-carbonyl precursor, thereby forming a metal layer on the substrate; and

repeating the exposing processes until a metal layer with a desired thickness is formed.

2. The method according to claim 1, wherein the metal-carbonyl precursor comprises at least one of $W(CO)_6$, $Ni(CO)_4$, $Mo(CO)_6$, $Co_2(CO)_8$, $Rh_4(CO)_{12}$, $Re_2(CO)_{10}$, $Cr(CO)_6$, and $Ru_3(CO)_{12}$.

3. The method according to claim 1, wherein the metal layer comprises at least one of W, Ni, Mo, Co, Rh, Re, Cr, and Ru.

4. The method according to claim 1, wherein the metal-carbonyl precursor gas comprises $W(CO)_6$.

5. The method according to claim 2, wherein a flow rate of metal-carbonyl precursor is between about 0.1 sccm and about 200 sccm.

6. The method according to claim 2, wherein the metal-carbonyl precursor gas further comprises at least one of a carrier gas and a dilution gas.

7. The method according to claim 6, wherein the at least one of a carrier gas and a dilution gas comprises an inert gas.

8. The method according to claim 7, wherein the inert gas comprises at least one of Ar, He, Kr, Xe, and N_2.

9. The method according to claim 6, wherein the precursor gas includes a carrier gas having a flow rate between about 10 sccm and about 1000 sccm.

10. The method according to claim 6, wherein the precursor gas includes a dilution gas having a flow rate between about 10 sccm and about 1000 sccm.

11. The method according to claim 1, wherein the reducing gas comprises at least one of a a hydrogen-containing gas, a silicon-containing gas, a boron-containing gas, and a nitrogen-containing gas.

12. The method according to claim 11, wherein the reducing gas includes a hydrogen-containing gas comprising H_2.

13. The method according to claim 11, wherein the reducing gas includes a silicon-containing gas comprising at least one of SiH_4, Si_2H_6, and $SiCl_2H_2$.

14. The method according to claim 11, wherein the reducing gas includes a boron-containing gas comprising at least one of BH_3, B_2H_6, and B_3H_9.

15. The method according to claim 11, wherein the reducing gas includes a nitrogen-containing gas comprising NH_3.

16. The method according to claim 11, wherein a flow rate of the reducing gas is between about 10 sccm and about 1000 sccm.

17. The method according to claim 1, further comprising exposing a purge gas to the substrate.

18. The method according to claim 17, wherein the purge gas comprises an inert gas.

19. The method according to claim 18, wherein the inert gas comprises at least one of Ar, He, Kr, Xe, and N_2.

20. The method according to claim 17, wherein a flow rate of the purge gas is between about 50 sccm and about 1000 sccm.

21. The method according to claim 1, wherein the length of the metal-carbonyl precursor gas pulse is between about 1 sec and about 500 sec.

22. The method according to claim 1, wherein the length of the metal-carbonyl precursor gas pulse is about 25 sec.

23. The method according to claim 1, wherein time period between the metal-carbonyl precursor gas pulses is between about 1 sec and about 120 sec.

24. The method according to claim 1, wherein the time period between the metal-carbonyl precursor gas pulses is about 30 sec.

25. The method according to claim 1, wherein the substrate temperature is between about 250° C and about 600° C.

26. The method according to claim 1, wherein the substrate temperature is between about 400° C and about 500° C.

27. The method according to claim 1, wherein a process chamber pressure is between about 0.01 Torr and about 5 Torr.

28. The method according to claim 1, wherein a process chamber pressure is less than about 0.2 Torr.

29. The method according to claim 1, wherein a process chamber pressure is about 0.04 Torr.

30. The method according to claim 1, wherein the metal layer formed during each pulse of a metal-carbonyl precursor gas is between about 5 A and about 60 A thick.

31. The method according to claim 1, wherein the metal layer formed during each pulse of a metal-carbonyl precursor gas is between about 5 A and about 10 A thick.

32. The method according to claim 1, wherein the desired thickness of the metal layer is less than about 500 A.

33. The method according to claim 1, wherein the substrate comprises at least one of a semiconductor substrate, a LCD substrate, and a glass substrate.

34. The method according to claim 1, further comprising depositing a metal nucleation layer on the substrate.

35. The method according to claim 34, wherein the depositing comprises utilizing a process selected from at least one of CVD, PECVD, and PVD.

36. The method according to claim 34, wherein the depositing utilizes a CVD process comprising exposing the substrate to a metal-carbonyl precursor gas.

37. The method according to claim 34, wherein the depositing utilizes a CVD process employing a process chamber pressure between about 0.1 Torr and about 5 Torr.

38. The method according to claim 34, wherein the depositing utilizes a CVD process employing a process chamber pressure of about 0.5 Torr.

39. The method according to claim 1, wherein the substrate comprises a plurality of microstructures and the method further comprises:

forming a metal layer having a first thickness on the bottom of at least one microstructure, a second thickness on the sidewall of the at least one microstructure, and an overhang at the top of the at least one microstructure.

40. The method according to claim 39, wherein the width of the at least one microstructure is less than about 0.4 micron.

41. The method according to claim 39, wherein the width of the at least one microstructure is less than about 0.15 micron.

42. The method according to claim 39, wherein the width of the at least one microstructure is less than about 0.1 micron.

43. The method according to claim 39, wherein the depth of the at least one microstructure is greater than about 1 micron.

44. The method according to claim 39, wherein the aspect ratio of the at least one microstructure is greater than about 3:1.

45. The method according to claim 39, wherein the first thickness is greater than about 10 A.

46. The method according to claim 39, wherein the first thickness is greater than about 50 A.

47. The method according to claim 39, wherein the first thickness is greater than about 150 A.

48. The method according to claim 39, wherein the second thickness is greater than about 10 A.

49. The method according to claim 39, wherein the second thickness is greater than about 50 A.

50. The method according to claim 39, wherein the second thickness is greater than about 150 A.

51. The method according to claim 39, wherein the ratio of the first thickness and the metal layer thickness adjacent to the at least one microstructure is greater than about 0.1.

52. The method according to claim 39, wherein the ratio of the second thickness and the thickness of the metal layer adjacent to the at least one microstructure is greater than about 0.1.

53. The method according to claim 39, wherein the ratio of the thickness of the overhang and the thickness of the metal layer adjacent to the at least one microstructure is less than about 0.7.

54. The method according to claim 39, wherein the ratio of the thickness of the overhang and the thickness of the metal layer adjacent to the at least one microstructure is less than about 0.5.